

AMENDMENTS TO THE CLAIMS

This listing of claims replaces all prior versions, and listings, of claims in the application:

LISTING OF CLAIMS

1. (previously presented) A method of electroplating an alloy comprising nickel, cobalt, and boron comprising:

providing an electroplating bath comprising an anode, a cathode, water, ionic nickel, ionic cobalt, an amine-borane compound, and at least one acetylenic brightener; and

applying a current to the electroplating bath whereby the alloy comprising nickel, cobalt, and boron forms on the cathode.

2. (previously presented) The method of claim 1, wherein the electroplating bath further comprises at least one sulfur containing brightener selected from the group consisting of sulfinic acids, sulfonic acids, aromatic sulfonates, aromatic sulfinates, sulfonamides, sulfonimides, sulfimides, and sulfo-betaines.

3. (previously presented) The method of claim 1, wherein the acetylenic brightener is selected from the group consisting of acetylenic alcohols, acetylenic amines, acetylenic esters, acetylenic sulfonic acids and sulfonates, alkoxylated acetylenic alcohols, and acetylenic carboxylic acids.

4. (previously presented) The method of claim 1, wherein the electroplating bath comprises about 40 g/l or more and about 100 g/l or less of ionic nickel, about 1 g/l or more and about 30 g/l or less of ionic cobalt, about 0.2 g/l or more and about 10 g/l or less of the amine-borane compound, and from about 0.001 % to about 5 % by weight of at least one acetylenic brightener.

5. (previously presented) The method of claim 1, wherein the electroplating bath has a pH from about 2 to about 6 and a temperature from about 10 °C to about 90 °C, and a current density of about 1 ASF or more and about 500 ASF or less is applied to the electroplating bath.

6. (currently amended) The method of claim 1, wherein the electroplating bath is provided by combining water; at least one nickel compound selected from the group consisting of nickel acetate, nickel acetylacetone, nickel ethylhexanoate, nickel carbonate, nickel formate, nickel nitrate, nickel oxalate, nickel sulfate, nickel sulfamate, nickel sulfide, nickel chloride, nickel fluoride, nickel iodide, nickel bromide, nickel oxide, nickel tetrafluoroborate, nickel phosphide, and hydrates thereof; at least one cobalt compound selected from the group consisting of cobalt acetate, cobalt acetylacetone, cobalt ethylhexanoate, cobalt carbonate, cobalt nitrate, cobalt oxalate, cobalt sulfate, cobalt chloride, cobalt fluoride, cobalt hydroxide, cobalt iodide, cobalt bromide, cobalt oxide, cobalt boride, cobalt tetrafluoroborate, and hydrates thereof; ~~at least one boron an amine-borane~~ compound selected from the group consisting of dimethylamine borane, t-butylamine borane, triethylamine borane, ~~trimethylamine borane~~, and hydrates thereof; and at least one acetylenic brightener.

7. (original) The method of claim 1, wherein the anode comprises at least one of nickel, cobalt, boron, iridium oxide, platinum, titanium, graphite, carbon, and platinum-titanium.

8. (original) The method of claim 1, wherein the nickel cobalt boron alloy comprises about 2 % by weight or less of components other than nickel, cobalt, and boron.

9. (currently amended) A method of forming an alloy comprising nickel, cobalt, and boron comprising:

providing an electroplating bath comprising an anode, a cathode, water, about 40 g/l or more and about 100 g/l or less of ionic nickel, about 1 g/l or more and about 30 g/l or less of ionic cobalt, and about 0.1 g/l or more and about 10 g/l or less of platable boron from an amine-borane compound selected from the group consisting of dimethylamine borane, t-butylamine borane, triethylamine borane, and hydrates thereof, and from about 0.005 % to about 2.5 % by weight of at least one acetylenic brightener; and

applying a current to the electroplating bath whereby the alloy comprising nickel, cobalt, and boron forms on the cathode.

10. (previously presented) The method of claim 9, wherein the electroplating bath has a pH from about 3 to about 5 and a temperature from about 30 °C to about 80 °C, and a current density of about 10 ASF or more and about 200 ASF or less is applied to the electroplating bath.

11. (previously presented) The method of claim 9, wherein the electroplating bath further comprises at least one sulfur containing brightener selected from the group consisting of sulfinic acids, sulfonic acids, aromatic sulfonates, aromatic sulfinates, sulfonamides, sulfonimides, sulfimides, and sulfo-betaines.

12. (previously presented) The method of claim 9, wherein the acetylenic brightener is selected from the group consisting of acetylenic alcohols, acetylenic amines, acetylenic esters, acetylenic sulfonic acids and sulfonates, alkoxylated acetylenic alcohols, and acetylenic carboxylic acids.

13. (previously presented) The method of claim 11, wherein the sulfur containing brightener is a sulfo-betaine brightener.

14. (canceled)

15. (currently amended) The method of claim 9, wherein the electroplating bath further comprises at least one organic brightener selected from the group consisting of ethylenic alcohols, coumarins, aldehydes, compounds containing a C≡N linkage, and heterocyclics.

16. (currently amended) A method of plating a substrate with a nickel cobalt boron alloy comprising:

providing an electroplating bath comprising an anode, a cathode substrate, water, ionic nickel, ionic cobalt, an amine-borane compound selected from the group consisting of dimethylamine borane, t-butylamine borane, triethylamine borane, and hydrates thereof, and at least two brighteners selected from the group consisting of sulfur containing brighteners and acetylenic brighteners; and

applying a current to the electroplating bath whereby a nickel cobalt boron alloy forms on the cathode substrate.

17. (previously presented) The method of claim 16, wherein the sulfur containing brightener is selected from the group consisting of sulfinic acids, sulfonic acids, aromatic sulfonates, aromatic sulfinites, sulfonamides, sulfonimides, sulfimides, and sulfo-betaines.

18. (previously presented) The method of claim 16, wherein the acetylenic brightener is selected from the group consisting of acetylenic alcohols, acetylenic amines, acetylenic esters, acetylenic sulfonic acids and sulfonates, alkoxylated acetylenic alcohols, and acetylenic carboxylic acids.

19. (previously presented) The method of claim 16, wherein the electroplating bath has a pH from about 3.5 to about 4.5 and a temperature from about 40 °C to about 70 °C, and a current density of about 20 ASF or more and about 100 ASF or less is applied to the electroplating bath.

20. (previously presented) The method of claim 16, wherein the electroplating bath comprises from about 0.01% to about 1% by weight of the at least two brighteners.

21. (original) The method of claim 16, wherein the electroplating bath further comprises at least one conductivity salt.

22. (original) The method of claim 21, wherein the conductivity salt is selected from the group consisting of boric acid, sodium sulfate, sodium chloride, potassium sulfate, and potassium chloride.

23. (previously presented) The method of claim 1, wherein the acetylenic brightener is selected from the group consisting of ethoxylated butynediol; 2-butyne-1,4-diol; propargyl alcohol; ethoxylated propargyl alcohol; hydroxyethyl propynyl ether; beta-hydroxypropyl, propynyl ether; gamma-propynyloxy, bis-beta-hydroxyethyl ether 2-butyn-1,4-diol; bis-beta-hydroxypropyl ether 2-butyn-1,4-diol; 1,4-di-(beta-hydroxyethoxy)-2-butyne; 1,4-di-(beta-hydroxy-gamma-chloropropoxy)-2-butyne; 1,4-di-(beta-gamma-epoxypropoxy)-2-butyne; 1,4-di-(beta-hydroxy-gamma-butoxoy)-2-butyne; 1,4-di-(2'-hydroxy-4'-oxa-6'-heptenoxy)-2-butyne; 2,4,6-trimethyl N-propargyl pyridinium bromide; 2-methyl-3-butyn-2-ol; 1-(beta-hydroxyethoxy)-2-propyne; and 1-(beta-hydroxypropoxy)-2-propyne.

24. (previously presented) The method of claim 9, wherein the acetylenic brightener is selected from the group consisting of ethoxylated butynediol; 2-butyne-1,4-diol; propargyl alcohol; ethoxylated propargyl alcohol; hydroxyethyl propynyl ether; beta-hydroxypropyl, propynyl ether; gamma-propynyloxy, bis-beta-hydroxyethyl ether 2-butyn-1,4-diol; bis-beta-hydroxypropyl ether 2-butyn-1,4-diol; 1,4-di-(beta-hydroxyethoxy)-2-butyne;

1,4-di-(beta-hydroxy-gamma-chloropropoxy)-2-butyne;
1,4-di-(beta-gamma-epoxypropoxy)-2-butyne;
1,4-di-(beta-hydroxy-gamma-butenoxy)-2-butyne;
1,4-di-(2'-hydroxy-4'-oxa-6'-heptenoxy)-2-butyne; 2,4,6-trimethyl N-propargyl pyridinium bromide; 2-methyl-3-butyn-2-ol; 1-(beta-hydroxyethoxy)-2-propyne; and
1-(beta-hydroxypropoxy)-2-propyne.

25. (previously presented) The method of claim 16, wherein the acetylenic brightener is selected from the group consisting of ethoxylated butynediol; 2-butyne-1,4-diol; propargyl alcohol; ethoxylated propargyl alcohol; hydroxyethyl propynyl ether; beta-hydroxypropyl, propynyl ether; gamma-propynyloxy, bis-beta-hydroxyethyl ether 2-butyn-1,4-diol; bis-beta-hydroxypropyl ether 2-butyn-1,4-diol; 1,4-di-(beta-hydroxyethoxy)-2-butyne;
1,4-di-(beta-hydroxy-gamma-chloropropoxy)-2-butyne;
1,4-di-(beta-gamma-epoxypropoxy)-2-butyne;
1,4-di-(beta-hydroxy-gamma-butenoxy)-2-butyne;
1,4-di-(2'-hydroxy-4'-oxa-6'-heptenoxy)-2-butyne; 2,4,6-trimethyl N-propargyl pyridinium bromide; 2-methyl-3-butyn-2-ol; 1-(beta-hydroxyethoxy)-2-propyne; and
1-(beta-hydroxypropoxy)-2-propyne.